

26402 - Crystallography

Información del Plan Docente

Academic Year	2018/19
Subject	26402 - Crystallography
Faculty / School	100 - Facultad de Ciencias
Degree	296 - Degree in Geology
ECTS	6.5
Year	1
Semester	Second semester
Subject Type	Basic Education

Module

1.General information

1.1.Aims of the course

1.2.Context and importance of this course in the degree

1.3.Recommendations to take this course

2.Learning goals

2.1.Competences

2.2.Learning goals

2.3.Importance of learning goals

3.Assessment (1st and 2nd call)

3.1.Assessment tasks (description of tasks, marking system and assessment criteria)

4.Methodology, learning tasks, syllabus and resources

4.1.Methodological overview

The methodology followed in this course is oriented towards the achievement of the learning objectives. It favors the understanding of the different crystallographical processes that occur in minerals. A wide range of teaching and learning tasks are implemented, such as theory sessions, laboratory sessions and assignments.

4.2.Learning tasks

This 6.5 ECTS course is organized as follows:

- **Lectures** (3.3 ECTS: 33 hours). Lecture notes and the most relevant bibliography will be available for the students.

26402 - Crystallography

Students are expected to participate actively throughout the semester.

- **Laboratory sessions** (1.4 ECTS: 14 hours). Two-hour sessions
- **Practice sessions** (1.8 ECTS: 18 hours)
- **Assessment tasks** (5 hours)
- **Autonomous work and study** (92.5 hours).

4.3.Syllabus

This course will address the following topics:

Section 1. Geometric crystallography

- **Topic 1.** The notion of crystal: historic development of Crystallography. Order and periodicity. The properties of crystalline matter.
- **Topic 2.** Crystal lattices. Bidimensional periodic lattices. The Bravais lattices and the crystal systems. Elements of periodic lattices
- **Topic 3.** Crystallographic notations: lattice points, lines and planes. Weiss parameters and Miller indices. Relationship between crystal morphology and structure. Empirical laws
- **Topic 4.** Crystallographic zones.
- **Topic 5.** Symmetry I. Symmetry operations in 2D and 3D
- **Topic 6.** Symmetry II. Translational symmetry. The 32 point groups. Crystal systems and symmetry.
- **Topic 7.** Crystal morphology. Forms of the 7 systems.
- **Topic 8.** Representing Crystals: stereographic projection.

Section 2. Structural crystallography and crystal chemistry

- **Topic 9.** The symmetry of the unit cell. Space groups. Atomic positions and structural sites.
- **Topic 10.** Crystal structures. Rules of the crystal structures. Pauling rules.
- **Topic 11.** Chemical variability of crystals: solid solution, isomorphism and stoichiometry (this course will be taught in English)
- **Topic 12.** The X-ray diffraction of crystals. Diffraction methods: fundamentals and the information they provide.

Section 3. Physical properties of crystals

- **Topic 13.** Introduction to the physical properties of crystals, and its relationship with the crystal symmetry
- **Topic 14.** Optical properties I. Nature of light and other basics
- **Topic 15.** Optical properties II. Optical isotropy and anisotropy. The optical surfaces.
- **Topic 16.** Optical properties III. The transmitted-light polarizing microscope.
- **Topic 17.** Optical properties IV. Optical analysis of crystals with parallel light, without analyzer. Optical analysis with parallel light and analyzer. Optical analysis with convergent light.
- **Topic 18.** The color of mineral.
- **Topic 19.** The electrical, magnetic and thermal properties of crystals.

Section 4. Crystal Dynamics

- **Topic 20.** The real crystal. Defects in crystals and crystal dynamics. The influence of defects on the physical properties of the crystals.
- **Topic 21.** Crystal defects: point, line, two and three dimensional defects in crystals.
- **Topic 22.** Crystal formation and growth. The morphology of the real crystal. Aggregates and twins.
- **Topic 23.** Polymorphism.

Practice sessions

- **Sessions 1 to 7.** Geometrical crystallography.
- **Session 9.** X-ray Diffraction.
- **Sessions 10-16.** Optical microscopy.

26402 - Crystallography

- **Practice.** Review of Geometric Crystallography

4.4. Course planning and calendar

Further information concerning the timetable, classroom, office hours, assessment dates and other details regarding this course will be provided on the first day of class or please refer to the Faculty of Sciences and Earth Sciences Department websites (<https://ciencias.unizar.es>; <https://cienciantierra.unizar.es>) and Moodle.

4.5. Bibliography and recommended resources